

as necessary as references to the ordinary scientific journals.

In reading chemical compilations of German origin we are sometimes struck by the scant attention received by work done in this country, and are often forced thereby to the conclusion that the author's study of English chemistry is limited to the system of abstracts issued by the Berlin Chemical Society. No such fault can be found here; the author is obviously as much at home in the *Journal of the Chemical Society* as in the Continental journals, and gives full credit to all results, from whatever source they are derived.

For Aschan's new book, as a whole, nothing but praise is possible, and the few points to which objections have been made rank as nothing when regarded as raised from the perusal of a book 1200 pages long, which aims at giving a systematic account of the alicyclic compounds. The study of these substances has been mainly carried out at fever heat during the past quarter of a century, and the necessarily ragged way in which the results have been laid before the world in the current journals must have offered immense difficulties to the compiler.

We cannot close this book, containing as it does a lucid account of one of the most important and intricate sections of organic chemistry, without reflecting with pleasure that the intense but systematic work which has led, during the last twenty years, to the synthetic building up of such complex molecular structures as those of camphor and of the terpenes has been largely carried out in our own country.

W. J. P.

THE SYSTEM OF THE FIXED STARS.

Der Bau des Fixsternsystems mit besonderer Berücksichtigung der photometrischen Resultate.

By Prof. Hermann Kobold. Pp. xi+256. (Brunswick: Vieweg und Sohn, 1906.) Price 5.60 marks.

TO prove that the stars form a stable system is a problem that has had attractions for many philosophical minds. The problem has not been solved, possibly may not be capable of solution, but the attractiveness of the speculation remains. Analogy with the solar system has suggested, and given support to, such an idea. The harmony that is to be perceived in the ordered motions of the planets, permitting countless revolutions to be performed without permanent change or irregularity, might well give rise to the hope that the same principle that governs the solar system could be detected in the larger scheme of the stellar universe. Such an idea would naturally have sway at a time when speculation was little fettered by numerical data drawn from rigorous observation. If there was little evidence to support the notion, there was nothing to contradict it. Kant or Lambert could suggest without difficulty that the stability of the system was secured by each star moving in a definite orbit, which ensured the maintenance of the general form and arrangement. The influence that that thought has exercised on modern

investigation is of more importance than the thought itself. To suspect the influence of the Milky Way in the scheme of the Cosmos, and to make its investigation the centre of inquiry, was to bequeath us a legacy which is by no means exhausted. Later schemes suggested by improved instrumental appliances have widened the scope and raised fresh issues, but the significance of the Milky Way remains. Similarly with the problem of the sun's motion, which a hundred years ago Herschel solved so satisfactorily, considering the character of his material. Disputed by Bessel and supported by Argelander and a host of later astronomers, the solution has passed through many stages and given rise to novel methods of treatment, involving the application of fresh hypotheses. In these later times we have pressed into the service the results brought to light by the spectroscope, especially difficult of interpretation as they are, and allowing the exercise of much ingenuity. But the essential problem remains the same. The only question is, What advances have we made in solving the riddle which perplexed earlier investigators?

In proportion as the problem becomes more and more complicated, either by repetition of similar processes or the introduction of fresh ones, the greater is the necessity for the examination of the evidence to test its value in combination, and of bringing the whole material to bear in one consecutive argument. This is the task which Dr. Kobold has undertaken, and in which he has acquitted himself with credit. One may not in every case draw the same conclusion, or with the same certainty, that the author does, but the evidence is at least presented with completeness, and we have the opportunity of bringing our critical faculty to bear upon the various lines of argument which are marshalled in review. Such a book is instructive to the tyro and suggestive to the expert. The one may adopt the conclusions which the author has drawn up, as indicating the general position of science towards this problem, the other may see the necessity for pursuing fresh lines of research, or of supporting alternative explanations of the results presented. In any case it is an advantage to see what has been attempted and what has been accomplished.

The author divides his book into three sections. In the first he describes on broad lines how the facts which may aid in solving the problem of the construction of the universe have been collected. The reader who comes fresh to this subject, without any previous acquaintance, gains an intelligent notion of the manner in which the positions of the stars have been ascertained, and can grasp clearly the supreme importance of an accurate determination of the precession constant when the question of proper motion is considered. The brilliancy and the colour of stars are both discussed, though the practical bearing of the latter point on this particular problem is not very clear, and in any case is more conveniently dealt with in discussing the spectroscopic observations, which are also brought under notice. Parallax and stellar distribution are adequately described, and therefore in this section we get a tolerably complete sketch of the main processes of stellar observation, except in

the department of double and variable stars. Into the significance of variable, and especially of "new stars," the author does not enter. Doubtless he is well advised in considering the introduction of such topics premature, but the omission shows that we have a certain class of facts which cannot yet be brought into line with other data. We have not yet succeeded in weaving our information into a consistent whole.

In the second section we have the results of observation mainly as exemplified in the production of star catalogues, whether of place or of spectrum, of brilliancy or of distance, for in these catalogues, applying, as they do, to large areas in the sky, must be contained the information which is to solve the problem of the universe. No inconsiderable portion of this section is occupied with the question of proper motion and the proper method of its treatment. Here we have raised for us, in an acute form, the question of the parallactic as distinguished from the actual motion of the star, and the legitimacy of the assumption as to the absolute lawlessness of direction of the star's own motion. On this and similar points a certain amount of controversy exists, and Dr. Kobold is known to hold very definite views. Fortunately we do not consider it necessary to enter into any of these differences of opinion. We are simply concerned in pointing out the general direction to which the combined information points, and its bearing upon the existence of a stellar system. These conclusions Dr. Kobold collects in his third section, and, greatly daring, has summarised "on half a sheet of note-paper." This statement is so succinctly expressed that it may be reproduced almost literally. Throughout a finite space of spherical form are scattered bodies very different in mass and in physical conditions. With gaseous nebulae at very low temperature occur other bodies in a condition of glowing heat and advanced condensation. The arrangement of the separate masses is not uniform; they are crowded together in clusters about certain centres of concentration. These groups possess a loose relationship, and are arranged in the form of a spiral having many branches. In the more distant parts of this spiral the hotter and gaseous stars predominate. The sun is comparatively near to the centre of this spiral, and the stars which stand in closest connection with it have also similar physical conditions. On the sun is impressed a motion towards a point in the Milky Way, the principal plane of the whole spiral, and a great number of stars near the sun participate in this same motion. Among the stars there are numerous groups having an apparent motion directed to points in the Milky Way. The stars of each group are in one plane, and their true motion, on the character of which definite information is still wanting, takes place in this plane.

This may seem a very small outcome for so much work, but it will hardly be urged that the author has erred on the side of caution. In any case this "Schlusswort" is valuable, since it expresses the opinion of one who is especially qualified to speak on a subject which possesses in an equal measure both interest and difficulty.

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A PHYSIOLOGICAL STUDY OF THE BRITISH FLORA.

British Flowering Plants. By the Right Hon. Lord Avebury. Pp. xxiii+450. (London: Macmillan and Co., Ltd., 1905.) Price 15s. net.

LORD AVEBURY has given us in the past several delightful books on botanical subjects, dealing more especially with the forms and functions of leaves, flowers, and fruits. At the time when the earlier of these books were published there was a tendency to reduce botanical morphology to a cut-and-dried series of shapes and forms, each designated by a Latin name the correctness of which received more attention than the purpose served by the various modifications. In "Flowers, Fruits, and Leaves," and "British Wild Flowers in Relation to Insects," Sir John Lubbock adopted the more natural treatment of studying form in the light of function, with the result that on account of their broad conceptions and the appeal they made to the reasoning faculty, these books obtained a wide circulation, and even now they maintain their position among the foremost contributions to the subject. In the circumstances the author has drawn freely from his previous works in writing this volume, which is restricted to British plants, and contains shorter or longer references to all our flowering plants. It provides, therefore, a running commentary to British floras in general and to Bentham's "British Flora" in particular.

On the details of buds and stipules, a subject that Lord Avebury has studied very carefully, much information is provided. In the genus *Lathyrus* the shape of the stipules varies from the large foliaceous type of *Lathyrus maritimus* through the narrow sagittate stipules of *Lathyrus pratensis* to the minute, slender stipules that occur in *Lathyrus nissolia*. These and other forms found in the genus are collated, and it is pointed out how the shape fits in with the attachment of the leaf to the stem. The complex nature of the stipules of the hawthorn also receives elucidation. A full account is given of the winter buds of the beech, the pine, and the spruce. It will be seen from these that the examination and dissection of the winter buds of trees and shrubs provide a capital exercise for a nature-study class. Considerable attention has been paid to the dichogamous and diclinous conditions of flowers. The ordinary strawberry furnishes a good instance. Darwin distinguished female flowers producing plenty of fruit, complete flowers less fertile, and male flowers naturally bearing no fruit. Schulz observed for the same plant gynomonœcious, andromonœcious, gynodioecious, and androdioecious forms. This is only one of several types of variation in the flower that too frequently pass unnoticed. A certain amount of work has been published on floral variation, more recently by students of biometric problems, but there is plenty of opportunity for observations continued over a series of generations to obtain more definite conclusions on the subject of small variations.

An introductory chapter deals with categories and types, as for instance, flowers of water plants,